

# Bromine

**Br**

## ***General Information***

### **Discovery**

Bromine was discovered by A.J. Balard in 1826 in Montpellier, France.

### **Appearance**

Bromine is a red, dense liquid with a sharp, distinctive smell. It is poisonous and is extremely corrosive to skin.

### **Source**

Bromine is extracted from natural brine deposits in the USA and elsewhere. It was the first element to be extracted from seawater, but this is no longer economically viable as seawater contains only 65 parts per million of bromine.

### **Uses**

Bromine is used in many areas such as agricultural chemicals, dyestuffs, chemical intermediates and flame-retardants. Most is used to prepare 1,2-di-bromoethane which is used as an anti-knock agent in combustion engines.

### **Biological Role**

Bromine has no known biological role. It has an irritating effect on the eyes and throat, and produces painful sores when in contact with the skin.

### **General Information**

Bromine combines readily with many elements. Like chlorine, it has a natural bleaching action.

## Physical Information

Atomic Number	35
Relative Atomic Mass ( $^{12}\text{C}=12.000$ )	79.904
Melting Point/K	266
Boiling Point/K	332
Density/kg m <sup>-3</sup>	3122 (293K)
Ground State Electron Configuration	[Ar]3d <sup>10</sup> 4s <sup>2</sup> 4p <sup>5</sup>
Electron Affinity (M-M <sup>-</sup> )/kJ mol <sup>-1</sup>	-324

## Key Isotopes

Nuclide	<sup>77</sup> Br	<sup>79</sup> Br	<sup>81</sup> Br	<sup>82</sup> Br
Atomic mass		78.918	80.916	81.917
Natural abundance	0%	50.69%	49.31%	0%
Half-life	57 h	stable	stable	35.5 h

## Ionisation Energies/kJ mol<sup>-1</sup>

M - M <sup>+</sup>	1139.9
M <sup>+</sup> - M <sup>2+</sup>	2104
M <sup>2+</sup> - M <sup>3+</sup>	3500
M <sup>3+</sup> - M <sup>4+</sup>	4560
M <sup>4+</sup> - M <sup>5+</sup>	5760
M <sup>5+</sup> - M <sup>6+</sup>	8550
M <sup>6+</sup> - M <sup>7+</sup>	9940
M <sup>7+</sup> - M <sup>8+</sup>	18600
M <sup>8+</sup> - M <sup>9+</sup>	23900
M <sup>9+</sup> - M <sup>10+</sup>	28100

## Other Information

Enthalpy of Fusion/kJ mol<sup>-1</sup> 10.8

Enthalpy of Vaporisation/kJ mol<sup>-1</sup> 30.5

### Oxidation States

Main Br<sup>-1</sup>, Br<sup>+5</sup>

Others Br<sup>+1</sup>, Br<sup>+3</sup>, Br<sup>+4</sup>, Br<sup>+7</sup>

### Covalent Bonds/kJ mol<sup>-1</sup>

Br - H 366

Br - C 285

Br - O 234

Br - F 285

Br - Br 193

Br - B 410

Br - Si 310

Br - P 264